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The Deccan Traps: A Lava Flow the Size of France

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The Deccan Traps: A Lava Flow the Size of France

Imagine lava poured out over a huge part of western and central India. It did not build a tall cone. It spread out and cooled into layers of dark rock. That rock is the **Deccan Traps**.

This lesson covers how big they are, when they erupted, and how they link to the end of the Cretaceous. It also shows the monuments cut from this rock. Every fact below comes from a research review or an international geology body.

What are the Deccan Traps, and how big are they?

How large is the Deccan province today?

The Deccan Volcanic Province is one of the largest magmatic regions known. A research review puts its present area at about **500,000 sq km**. The IUGS geoheritage page gives the same figure for its location on the western margin of peninsular India.

That is roughly the area of a large country. The lava lies mostly on the plateau of western and central India.

Sources: comptes-rendus.academie-sciences.fr; iugs-geoheritage.org



Quick check 1. The Deccan Volcanic Province covers about 500,000 sq km today. *(True or False?)* See answer ↓

How big was it before erosion?

The province was much larger once. Long erosion has cut it back. The review says estimates of the original area vary from researcher to researcher.

The figures run from about **1,000,000 sq km** to **1,500,000 sq km**, and some go past 1,800,000 sq km.

So do not memorise one single value as settled fact. Remember the range, and remember that the original was much bigger than today.

Sources: comptes-rendus.academie-sciences.fr

Quick check 2. Scientists agree on one single figure for the original area of the Deccan province. *(True or False?)* See answer ↓

What kind of rock is Deccan basalt?

The IUGS page describes the rock as **tholeiitic flood basalt**. It also names minor alkaline and acidic variants.

The colour changes with the type. Deccan basalt is brownish red in places. Massive basalt shows shades of grey to black.

The review adds that the lava pile is made of simple and compound **pahoehoe flows**. These are smooth, ropy lava flows.

Sources: iugs-geoheritage.org; comptes-rendus.academie-sciences.fr

How is the province divided, and how thick is it?

The review splits the province into four sub-provinces. They are the Main Deccan Plateau, the Eastern Deccan Plateau, the Malwa Plateau and the Saurashtra Plateau.

The Main Deccan Plateau lies south of the Narmada–Son rift valley. Its maximum thickness is about **3.5 km**.

The Malwa Plateau lies north of the Narmada valley. It covers about 80,000 sq km and averages 500 m in thickness. The Eastern Deccan Plateau is 900 m thick and covers about 29,400 sq km.

Sources: comptes-rendus.academie-sciences.fr

Main Deccan Plateau	Up to about 3.5 km thick.
Eastern Deccan Plateau	About 900 m thick.
Malwa Plateau	About 500 m on average.

Quick check 3. The Main Deccan Plateau has a maximum thickness of about 3.5 km. *(True or False?)* See answer ↓

When did the lava erupt, and what drove it?

When did the eruptions take place?

Published stratigraphic data suggest eruption between **69 and 64 million years ago**. Many textbooks quote about 66 million years as the centre of that window.

The review links the eruptions to the movement of the Indian plate over the **Réunion hotspot**.

Sources: comptes-rendus.academie-sciences.fr

How fast was the main phase?

The main phase was quick. About **80%** of all the basaltic lava erupted in it.

The review says this took less than one million years. It may have taken only two or three hundred thousand years.

That is a very short span for geology. It fits the idea of a flood basalt: a huge volume in a short time.

Sources: comptes-rendus.academie-sciences.fr

What is the Réunion hotspot?

A hotspot is a place where hot material rises from deep inside the Earth. The review says the Indian plate passed over the Réunion hotspot while the lava erupted.

The plume head of this hotspot is also part of the story. The review ties it to the main volcanic phase.

Sources: comptes-rendus.academie-sciences.fr

69–64 Ma ago Eruption window.
Main phase About 80% of the lava in under 1 Ma.
K–Pg boundary The main phase straddles it.

What frames the province on the map?

Four structures bound the main province. The Panvel Flexure lies to the west of the Western Ghats. The Narmada–Tapti rift system lies to the north.

The Cambay rift system lies to the north-west. The Godavari rift lies to the south-east.

Some flows even erupted on the sea floor along the coast of the Western Ghats, in the Arabian Sea.

Sources: comptes-rendus.academie-sciences.fr

> **Quick check 4.** About 80% of the Deccan lava erupted during the main phase. *(True or False?)* See answer ↓

Which numbers are worth remembering?

Keep a short list. The present area is about 500,000 sq km. The main plateau reaches about 3.5 km in thickness.

The eruption window is 69 to 64 million years ago. The main phase made about 80% of the lava.

Write each number with its meaning. A bare number is easy to forget under exam pressure.

Sources: comptes-rendus.academie-sciences.fr

Did the Deccan Traps help end the age of dinosaurs?

Where does the K–Pg boundary come in?

The K–Pg boundary separates the Cretaceous from the Paleogene. The review says the main Deccan phase falls close to chron 29R. It straddles this boundary.

That is why the Deccan Traps appear in every discussion of the end-Cretaceous mass extinction.

Sources: comptes-rendus.academie-sciences.fr

What does the review say about the Chicxulub impact?

The review reports recent high-precision age data. Those data show the main volcanic phase is **genetically linked** to the Chicxulub impact and the plume head of the hotspot.

It says both largely contributed to the end-Cretaceous mass extinction. The review treats them as linked events, not as simple rivals.

When you write an answer, name both causes. Say the timing is close, and avoid saying that one alone killed the dinosaurs.

Sources: comptes-rendus.academie-sciences.fr

How do scientists date the lava pile?

Sedimentary beds lie between the lava flows. They are called intertrappean beds. Beds below and between the flows have yielded many kinds of fossils.

The review says these fossils give a reliable relative time control for the length of the volcanic activity.

The dates also come from chemistry, magnetism and radiometric work. The review covers all of these methods.

Sources: comptes-rendus.academie-sciences.fr

> **Quick check 5.** Sedimentary beds between the lava flows help date the Deccan eruptions. *(True or False?)* See answer ↓

Which monuments are cut from Deccan basalt?

Why is Deccan basalt a heritage stone?

The International Union of Geological Sciences listed Deccan Basalt as a Heritage Stone in **2022**. The page says the rock has been used from antiquity to the present.

Four UNESCO World Heritage Sites in India are made from this basalt and its related trachyte. They are Ajanta, Ellora, the Elephanta caves and Chhatrapati Shivaji Maharaj Terminus, formerly Victoria Terminus.

Sources: iugs-geoheritage.org

How are the Elephanta Caves linked to the Traps?

The Elephanta caves are carved in basalt. They lie on the isolated Gharapuri Island in the Arabian Sea, off the Mumbai coast.

They host the famed Trimurti Mahesh, a form of Shiva. So a sculpture in a modern megacity sits in rock from an ancient eruption.

Sources: iugs-geoheritage.org

What about Ajanta and Ellora?

Ajanta is described as a second-century BC Buddhist cave monument cut in place into basalt. It has paintings and sculptures.

The Kailasa Temple at Ellora is called the largest monolithic rock-cut temple in the world. Prayer halls there have central stupas and large pillars carved in basalt.

Sources: iugs-geoheritage.org

Which other caves are in this rock?

The page also names rock-cut caves of lesser grandeur. They are at Bhaja, Karla and Bedse near Pune, and at Mahad in the Konkan.

Together these sites show one idea. The same lava that shaped the plateau gave builders a strong stone to carve.

Sources: iugs-geoheritage.org

Quick check 6. The Elephanta rock-cut caves are made of basalt. *(True or False?)* See answer ↓

Practice MCQs

1. What type of geological feature are the Deccan Traps?

A. A glacial moraine

B. A volcanic flood-basalt province

C. A limestone cave system

D. A coral reef formation

See answer ↓

2. What are the Deccan Traps, and roughly when did they erupt?

A. Coral reef formations, built up over 10,000 years

B. Wind-deposited sand dunes, formed within the last million years

C. Layers of solidified lava, erupted around 66 million years ago

D. Glacial moraines, deposited during the last ice age

See answer ↓

3. The Deccan Traps eruption coincides with which major event in Earth's history, and what is the ongoing scientific debate about it?

A. The origin of the monsoon; whether volcanism or ocean currents drive it

B. The Cretaceous-Paleogene mass extinction; whether volcanism or the Chicxulub asteroid impact was the main cause

C. The end of the last ice age; whether volcanism or solar activity caused the warming

D. The formation of the Himalaya; whether tectonic collision or erosion shaped it faster

See answer ↓

4. Roughly how large is the Deccan Traps' original extent estimated to have been, before erosion reduced it?

A. About 200,000 sq km

B. About 800,000 sq km

C. About 50,000 sq km

D. About 1.5 million sq km

See answer ↓

5. The Deccan Traps' eruption began around 66 million years ago, at the boundary between which two geological periods?

A. Paleogene and Neogene

B. Triassic and Jurassic

C. Cretaceous and Paleogene

D. Jurassic and Cretaceous

See answer ↓

6. Which fertile Indian soil type formed from the weathering of Deccan Traps basalt over millions of years?

A. Black (Regur) soil

B. Arid and desert soil

C. Alluvial soil

D. Laterite soil

See answer ↓

7. Where are the Elephanta Caves located?

A. Ellora, Maharashtra

B. Gharapuri island, Mumbai Harbour

C. Ajanta, Maharashtra

D. Salsette Island

See answer ↓

8. The Indian plate is said to have passed over which hotspot while the Deccan lava erupted?

A. Yellowstone hotspot

B. Réunion hotspot

C. Iceland hotspot

D. Hawaiian hotspot

See answer ↓

Answer Key

1. **B.** The Deccan Traps are a massive volcanic flood-basalt province, formed by repeated lava flows. ↑ Q1
2. **C.** The Deccan Traps are layers of solidified lava that erupted around 66 million years ago, forming most of the Deccan Plateau's surface. ↑ Q2
3. **B.** The Deccan Traps eruption coincides almost exactly with the Cretaceous-Paleogene mass extinction that wiped out the dinosaurs, and scientists still debate whether volcanism or the Chicxulub asteroid impact was the primary cause. ↑ Q3
4. **D.** The Deccan Traps originally covered about 1.5 million sq km, before erosion reduced their visible extent to roughly 500,000 sq km today. ↑ Q4
5. **C.** Eruption began around 66 million years ago, right at the K-Pg boundary, between the Cretaceous and Paleogene periods. ↑ Q5
6. **A.** Weathering of Deccan Traps basalt over millions of years produced the fertile Black (Regur) Soil found across much of the Deccan Plateau. ↑ Q6
7. **B.** The Elephanta Caves are rock-cut cave temples on Gharapuri island, in Mumbai Harbour, Maharashtra. ↑ Q7
8. **B.**
   A research review says the Indian plate passed over the Réunion hotspot during the eruptions. A hotspot is a place where hot material rises from deep inside the Earth. The review also ties the hotspot's plume head to the main volcanic phase.
   ↑ Q8

Quick-check answers

1. **True.** Both the research review and the IUGS page give about 500,000 sq km. ↑ 1
2. **False.** The review says estimates range from about 1,000,000 to over 1,800,000 sq km. ↑ 2
3. **True.** The review gives about 3.5 km as the maximum for the Main Deccan Plateau. ↑ 3
4. **True.** The review says the main phase produced about 80% of the total basaltic lava. ↑ 4

5. **True.** The review says fossils from these beds give relative time control. ↑ 5
6. **True.** The IUGS page says the Elephanta caves are carved in basalt on Gharapuri Island. ↑ 6

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